STAFF STUDY - "PHOTOGRAPHIC AND LINE SCAN IMAGERY EXPERIMENTATION" -

25X1 [redacted]

1. OBJECTIVE:

To develop the rationale for specifying image quality (ground resolution) requirements for the NPIC exploitation of specific targets on line-scan display systems. ("Line-scan" as used here means imagery presented on a cathode ray tube type of display.)

2. FACTS BEARING ON THE PROBLEM:

a. At present, line-scan acquisition systems are in the early design and development phase.

b. With the advent of this real-time strategic reconnaissance capability, NPIC may soon be tasked with the exploitation of line-scan imagery.

c. As prime user of this potential product, the Center should contribute to the specification of the collection system parameters which will eventually affect the exploitation capabilities.

d. Little information is currently available which can aid in objectively defining the relationship between image quality and interpretability of line-scan imagery.

e. It is technically feasible and relatively inexpensive to simulate the range of obtainable line-scan resolutions and then to perform a psychophysical study to determine optimum image quality parameters as dictated by NPIC exploitation requirements.

f. EXRAND objectives state that R&D "is to provide equipment and techniques for near real-time imagery inputs in the 1970's."

3. DISCUSSION:

NPIC has recently completed two important studies relating variable image quality to the corresponding extractability of specific target intelligence from photography. The first of these efforts,
25X1 both undertaken by [redacted] considered the resolution requirements for interpreting imagery of offensive missile sites. The second analyzed the resolution requirements for interpreting Sino-Soviet mobile radars. Among several other objectives, these studies sought to determine the level of image quality which, even if improved, would not yield further information of intelligence value about a given target. The results of these studies have clearly

demonstrated that individual components encompassed within gross target signatures possess unique resolution requirements for P.I. identification. Depending upon the depth to which the P.I. is tasked to report, resolution requirements even for the same target component will vary. The compiled data from the two studies include detailed listings of interpretation thresholds corresponding to specific target components and specific P.I. functional reporting requirements. These ground resolution tabulations, however, apply only to the conventional photographic acquisition and display situation and not to line-scan systems.

NPIC's stated positions on acquisition system design have rarely been timely enough to influence system planners. We now have the opportunity to at least begin to remedy this undesirable situation. This applied research task will result in objective parameter definitions pertaining both to optimum collection system characteristics and to NPIC's simultaneous display requirements.

4. THE PROPOSED PROGRAM:

The specific objective of the proposed effort is to develop the rationale for specifying line-scan image quality requirements. This goal will be achieved by constructing a scale of reference equating the already-defined photographic resolution break points against their corresponding line-scan break points. Equal amounts of extractable intelligence will be the criteria for establishing these correlated reference resolution levels.

A psychophysical experiment employing NPIC interpreters will form the main basis for the study. The Chief of the Imagery Exploitation Group has agreed to permit interpreters to take part in this study. Their participation will be scheduled in advance to insure that aggregate Technical Services and Support Group requirements for imagery interpreter support will not exceed two man-weeks per week. In cooperation with OSP/CIA, [redacted] Line Scan Image Generator will be used to convert the stimulus photography (employed previously in the missile and electronics studies) to line-scan records at a similar number of resolution intervals. Controlled P.I. analyses of the line scan imagery will then result in reports of interpreted target features. These reports in turn will be equated, at each resolution step, with the photographic resolution level that corresponds most closely in terms of the information exploited.

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This investigation will cost approximately [redacted] and can be completed in approximately eight months.

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5. CONCLUSIONS & RECOMMENDATIONS:

a. The data produced by the proposed experiments will be highly useful for providing system planners with NPIC's image quality requirements.

b. The data will be necessary for NPIC to logically plan for future equipment and techniques needed to exploit line-scan imagery.

25X1 c. [redacted] is uniquely qualified to perform the proposed experimental investigation, having designed and executed all of NPIC's previously-sponsored resolution research.

d. It is recommended that NPIC contract with [redacted] 25X1

25X1 [redacted] from FY-1969 funds to accomplish the above research program.